RICE
Department of Bioengineering
GRADUATE DEGREE REQUIREMENTS AND PROCEDURES

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Department of Bioengineering

Chair: Dr. Rebecca Richards-Kortum
Graduate Committee Chair: Prof. A. G. Mikos

August 2005
I. THE Ph.D. DEGREE

I.1 Curriculum

The Ph.D. curriculum consists of three components: foundation, supporting, and advanced topics courses. Collectively, they should afford the student broad exposure to her/his chosen field of research interest.

A. Foundation Courses — All graduate students in the Bioengineering program will take the following core courses:
   - Introduction to Bioengineering (BIOE 551 graded on pass/fail basis),
   - Biosystems Transport Phenomena (BIOE 520),
   - Fundamentals of Systems Physiology (BIOE 572), and
   - Introduction to Partial Differential Equations (MATH 381) or Differential Equations in Science and Engineering (CAAM 336).

B. Supporting Courses — Four major tracks that reflect research interests within the Bioengineering department are recognized. Students interested in a track are required to take two supporting courses in that area. Students who have already taken courses substantially similar to any of the required supporting courses may request to substitute an alternate course by submitting a memo to the graduate committee. The Table below presents the four tracks and the corresponding supporting courses.

<table>
<thead>
<tr>
<th>TRACK</th>
<th>REQUIRED SUPPORTING COURSES</th>
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| Cellular and Molecular Engineering (CME) | • Cell Biology (BIOS 341)  
|                                    | • Biochemistry I (BIOS 301)                                      |
| Bioinstrumentation, Imaging, and Optics (BIO) | Candidates must take two of following three:  
|                                    | • Computational Neuroscience (BIOE 481)  
|                                    | • Physiological Control Systems (BIOE 482)  
<p>|                                    | • Introduction to Biomedical Instrumentation and Measurement Techniques (BIOE 483) |</p>
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<tr>
<th>TRACK</th>
<th>REQUIRED SUPPORTING COURSES</th>
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<tbody>
<tr>
<td>Biomaterials and Biomechanics (BBM)</td>
<td>• Biomaterials Engineering (BIOE 531)</td>
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<tr>
<td></td>
<td>• Advanced Biomechanics (BIOE 575)</td>
</tr>
<tr>
<td>Computational Bioengineering (CBE)</td>
<td><strong>Candidates must take two of following four:</strong></td>
</tr>
<tr>
<td></td>
<td>• Computational Molecular Bioengineering (BIOE 589)</td>
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<tr>
<td></td>
<td>• Methods of Molecular Simulation (BIOE/PHYS 610)</td>
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<tr>
<td></td>
<td>• Statistical Methods in Bioinformatics (STAT 655)</td>
</tr>
<tr>
<td></td>
<td>• Statistical Mechanics (CENG 611 or CHEM 520 or PHYS 526)</td>
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<tr>
<td></td>
<td>• Systems Biology and Molecular Design (BIOE 515)</td>
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</tbody>
</table>

**C. Advanced Topics Courses** — A large array of advanced specialty courses are available to BIOE graduate students. Each student should select the courses most appropriate for her/his research work with the help of the thesis advisor and the graduate committee.

**D. Graduate Seminar Course** — Students must register for the graduate seminar (BIOE 698 (F) and BIOE 699 (S)) every semester of their first three years of study. Students beyond their third year are not required to attend but are highly encouraged to do so. This course is given on a pass/fail basis only. Attendance at seminars is mandatory unless the absence has been excused in advance by the course administrator. Graduate students may miss up to two seminars per semester. Seminars will be given by leaders from the field of bioengineering. In general, there will be a time scheduled for graduate students to meet with the seminar speaker for an informal discussion. Attendance at these sessions is not mandatory but strongly recommended.

**I.2 Course Requirements**
Ph.D. students entering Rice with a bachelor’s degree must take at least 36 semester hours of foundation, supporting and advanced topics courses and maintain a grade point average of at least 3.2. Courses in which a student receives a grade below a B- may not be used to fulfill the coursework requirement. All coursework must be at the “300” level or above. During their first semester in residence, all full-time Ph.D. students must register for at least four advanced courses, not including any taken on a pass/fail basis. Students who have received credit for graduate courses taken during their M.S. studies may petition the graduate studies committee to relax the requirement of registering for four advanced courses during the first semester. After the first semester, students should register for enough advanced courses so that they meet at all times the satisfactory progress requirements outlined in section I.8.

Ph.D. students entering Rice with a master’s degree may petition the graduate studies committee to receive credit for graduate courses taken during their M.S. studies. To do this, students should submit a memo and copies of all relevant transcripts to the graduate committee. Such credit will not exceed 18 semester hours, and these students must take at least 22 credit hours of advanced courses at Rice. The following restrictions also apply:

a) Each case must be individually approved by the graduate studies committee based on the work done for the M.S. degree.

b) A student may not count towards the Ph.D. requirements a course which is substantially the same as one completed during M.S. work. The decision as to whether a course is “substantially the same” will be made by the graduate studies committee.

c) As with all graduate students, the thesis advisor may require further course work if it is considered essential for the thesis research.

Students with an M.S. degree in bioengineering from Rice granted within three years prior to their entry into the Ph.D. program will have all courses taken during their M.S. work at Rice counted toward the 36 hour requirement.

The university minimum requirement for the doctorate degree is **90 semester hours** beyond the bachelor’s degree (60 hours beyond the master’s degree). Ph.D. students must earn the additional credits they need for graduation by registering for the thesis research course BIOE 800 (up to 12 credit hours per term) during the terms they are engaged in research.
Departmental policy requires that full-time students be registered for at least 12 credit hours each semester.

I.3 Teaching Requirement

Teaching is a graduate degree requirement. After their first semester in residence, students may be asked to spend the equivalent of six to ten hours per week for a total of three semesters on teaching assignments. Teaching assignments usually involve tutoring, leading recitation sections, grading papers or supervising work in the undergraduate laboratory. Note again that (a) students will not have any teaching responsibilities during their first semester in residence and (b) teaching responsibilities may be assigned for a maximum of three semesters. Students planning to pursue an academic career are encouraged to request more involved teaching assignments.

At the beginning of a teaching assignment, students should meet with their course faculty and discuss expectations and deadlines for the teaching assignment. At the end of the semester, there will be an evaluation of students’ performance in their teaching assignment. If a student receives an unsatisfactory rating, that semester will not count towards the maximum three semester assignment.

I.4 Selection of Principal Advisor and Thesis Topic

The faculty members of the bioengineering department will present their research topics to the first-year graduate students during the first half of the fall semester. After the presentations, students should visit at least three faculty members for detailed discussions on the research topics of most interest to them.

Before the end of their first semester of residence, all graduate students must submit to the graduate studies committee a list with their three top choices of research projects. These three choices must include topics offered by at least two faculty members. The final decision on research topic assignments is made during a departmental faculty meeting.
The selection process is coordinated by the department chair and the graduate studies committee in an effort to match the wishes and needs of the students to those of the faculty and to the available funded research projects.

I.5 Ph.D. Qualifying Examination

There is no Ph.D. qualifying examination.

I.6 Progress Report

All graduate students are required to submit a semiannual progress report. The report will be submitted to the bioengineering department office and the members of their thesis committee (see Thesis Proposal section). It should state the student’s progress with completed coursework and research, list any publications or conference presentations by the student, and describe the work planned for the next 6-month period. The due dates are January 31 and July 31.

I.7 Thesis Proposal

Before the beginning of their fifth semester in residence (excluding summers), Ph.D. students must have completed the following:

a) Selected a thesis committee,
b) Prepared a thesis proposal, and
c) Defended this proposal during a meeting of their thesis committee.

The thesis committee must consist of at least three faculty members; at least one committee member must be from outside the department, and at least two members must be from the department of Bioengineering.

The thesis proposal is a written summary of research progress up to that point and future research plans. This document should contain (as a minimum) the following sections:
a) Abstract (not to exceed 250 words),
b) Background with extensive literature survey,
c) Problem statement,
d) Research plans and methodology,
e) Any results obtained up to that point, and
f) Proposed time-line for completion of thesis research.

Portions of manuscripts or reports to sponsors (if available) could be incorporated in the thesis proposal.

The thesis proposal must be distributed to the members of the thesis committee at least one week before the scheduled meeting. This meeting should be viewed as an opportunity to assess the student’s progress and knowledge of the research field, to assure that the student has developed a coherent research plan, and to provide the student with input from the members of the committee in time to incorporate useful suggestions in the thesis research.

After the meeting, the thesis advisor should inform the graduate studies committee of the thesis committee’s evaluation of the student’s progress and of any recommended action.

**I.8 Internship Programs**

In addition to coursework, we require an industrial internship, of at least three months, as part of our unified, training program. This aspect is also a feature of our NIH Biotechnology Training Grant Program and has had a high degree of success. This requirement has been received well by the graduate student trainees in this program. The training program for each intern is organized via collaborative interaction between the advisor and representatives of the company. To request a waiver, students should submit a memo to the graduate committee with an additional letter of support from their research advisor.

Additionally, if a student hopes to perform their internship in a non-industrial setting, they should submit a memo to the graduate committee outlining the proposed internship and its relationship to the student's professional development to request
permission for this variance. The internship requirement, however, may be waived for program applicants who have adequate previous industrial experience.

The internship requires careful planning in order to maximize the overlap of particular industrial laboratory needs and expertise with graduate student interests and abilities. In many cases, the sponsoring company will financially support the intern during the period of internship and provide a stipend and travel expenses. Thus, the proposed internship program should provide the student with real-world exposure in a bioengineering research environment and bring about stronger industry/university ties.

I.9 Satisfactory Progress

Ph.D. students are expected to make continuous and **satisfactory progress** towards fulfilling their degree requirements. Satisfactory progress is defined as follows:

- By the end of the 1st semester in residence, Ph.D. students must have at least 12 semester hours of graduate courses (excluding courses taken on a pass/fail basis);
- They must maintain a GPA of 3.2 or better;
- After their 1st semester in residence, students must work on their thesis research on a full-time basis;
- They must submit their progress reports by the deadlines;
- They must submit and successfully defend their thesis proposal before the beginning of their fifth semester in residence; and
- Satisfactory evaluation of all TA assignments (maximum of three).

Students who fail to meet any of the above requirements will receive letters of warning. When a student receives such a letter, the graduate studies committee, in conjunction with the thesis advisor and the department chair, may decide to reduce her/his stipend on a prorated basis. Stipend reductions will remain in effect until the student makes up for the deficiency.

In cases of egregious failure to maintain satisfactory progress a student’s fellowship may be terminated. Decisions to reduce or terminate student stipends will be made on a
case-by-case basis. The graduate studies committee, the thesis advisor and the department chair will consider all the factors that may have affected a student’s performance before reaching such a decision.

I.10 Approval of Candidacy and Final Oral Examination

All Ph.D. students must submit a petition for approval of candidacy through the department chair to the Office of Graduate Studies. Since this petition must reach the Office of Graduate Studies before November 1 of the academic year in which graduation is expected, the students must fill the necessary departmental forms at least one week before that deadline. Final approval will come from the Associate Provost and is valid for four years.

After a student’s candidacy has been approved and upon completion of his/her research project the student must schedule, in coordination with his/her research advisor, a public oral examination for the defense of his/her thesis.

I.11 Acceptance of the Thesis

The completed thesis must be submitted in either final or advanced draft form to the members of the thesis committee at least one week before the oral examination. In the course of this examination, the thesis committee members may recommend revisions or additions, which must be incorporated in the final thesis, which is then signed by all committee members. Within one calendar year of passing the oral examination, the student must submit two copies of the signed, final thesis to the Office of Graduate Studies. Final approval of the thesis is by the Associate Provost.

II. THE M.S. DEGREE

M.S. students must satisfy the departmental and university course requirements, fulfill the teaching requirement, complete a research project, write a thesis and successfully defend their work in a public oral examination.
II.1 Course Requirements

M.S. students must take at least 18 semester hours of foundation, supporting and advanced courses as outlined in section I.1 above. A grade point average of 3.0 must be maintained at all times.

The university minimum credit requirement for the M.S. degree is 30 semester hours. M.S. students must earn the additional credits they need for graduation by registering for the master’s research courses BIOE 600 during the terms they are engaged in research.

Departmental policy requires that full-time students be registered for at least 12 credit hours each semester.

II.2 Teaching Requirement

All M.S. students must fulfill the teaching requirement as described in Section I.3 for Ph.D. candidates.

II.3 Thesis Requirements

M.S. students should select a thesis advisor and research topic according to the same procedure outlined in Section I.3 for Ph.D. candidates. Each student must complete a research project, write a thesis and successfully defend his/her work in a public oral examination.

All students seeking the M.S. degree must submit a petition for approval of candidacy through the departmental chair to the Office of Graduate Studies. Since this petition must reach the Office of Graduate Studies before March 1 of the academic year in which graduation is expected, the students must fill the necessary departmental forms at least one week before that deadline. Final approval will come from the Associate Provost and is valid for two years. The final oral examination in defense of the M.S. thesis can be given only after the candidacy has been approved.
A committee for the oral examination, known as the thesis committee, is selected at the time the candidacy is approved. The thesis committee must consist of at least three faculty members; at least two of the committee members must be from the department of Bioengineering. The thesis must be given to the committee members one week before the thesis defense.

### III. THE M.B.E. DEGREE

The Master of Bioengineering degree is intended for those having a BA or BS degree in an engineering or science discipline.

To obtain a Master of Bioengineering degree, the following requirements must be completed.

1 - Curriculum has to be approved by the Academic Affairs Committee of the Bioengineering department. (This will be done on a case-by-case basis.)

2 - Total of 30 credit hours is required (courses must be above and beyond the requirement for the undergraduate degree) as follows:

- At least 15 credit hours of the 30 must be taken as BIOE courses including Biosystems Transport and Reaction Processes (BIOE 520) and Fundamentals of Systems Physiology (BIOE 572)
- Introduction to Partial Differential Equations (MATH 381) (3 hours),
- One additional Engineering course (3 hours), and
- Three additional courses approved by the Academic Affairs Committee (9 hours).

In summary, the credit hours required are:

- Completion of 30 total credit hours, with 15 credit hours of BIOE courses,
- Completion of 3 credit hours of MATH 381
- Completion of 3 credit hours of one additional Engineering course, and
- Completion of 9 credit hours of additional courses approved by the Academic Affairs Committee
IV. FINANCIAL SUPPORT

Students who receive a stipend in support of their graduate work are expected to devote full-time to their studies and are not to take outside employment. Full-time for first-year students during their first semester of study is considered to consist of four or more advanced courses.

During the first semester of study graduate students observe the same holiday schedule as other students engaged in course work. Subsequently, students engaged in research receive two weeks paid vacation annually, in addition to designated staff holidays.

IV.1 Support Limitation Rule - Progress Report

The normal limit of financial support for graduate students is ten semesters (excluding summers). Students who anticipate taking longer than 10 semesters for completion of the Ph.D. degree, must submit an additional progress report. This report need not be lengthy but should (a) summarize work accomplished since the presentation of the thesis proposal, (b) provide specific information on research work remaining to be done and (c) indicate the estimated time for completion. Again, manuscripts, reports and even chapters of the thesis already written could be included.

The complete progress report should be submitted to the thesis committee no later than one month before the end of the tenth semester in residence. The thesis committee shall consider the report and recommendation of the thesis advisor and convey to the graduate studies committee its evaluation of the student’s progress. This evaluation should contain a recommendation on whether the student’s support should be terminated after ten semesters or whether exceptional circumstances exist which justify continued funding. In the latter case, a specific period for continued support, not to exceed one year in duration, shall be included in the recommendation.

The graduate studies committee will review the thesis committee’s recommendation and, in conjunction with the thesis advisor and the department chair, make a decision.
V. OTHER REGULATIONS

All graduate students are expected to maintain continuous enrollment, unless official leave of absence has been granted. Failure to register for any period without a leave of absence granted by the Associate Provost constitutes de facto withdrawal. If a student later wishes to resume study, reapplication is required. Readmission is given only on the recommendation of the department and the approval of the Associate Provost.

Leave of absence is granted only by the Graduate Office upon the recommendation of the department, and is granted only to students in good standing with the University. Leave must be approved in advance of the academic semester in question; it will not be granted after the student has registered for courses or after the registration period has passed. Normally, leave of absence is granted for no more than two consecutive semesters. No work toward a degree may be done at Rice or involve Rice faculty (or facilities) during a student's leave of absence.
## Important Milestones
### For Students Entering in August 2005

<table>
<thead>
<tr>
<th>Fall Semester 2005 (1st Semester)</th>
<th>Register for at least four graduate courses and the special first year student seminar course (BIOE 551) and the graduate seminar course (BIOE 698)</th>
</tr>
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<td><strong>When:</strong> End of August 2005</td>
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<table>
<thead>
<tr>
<th>Fall Semester 2005 (1st Semester)</th>
<th>Select thesis advisor and thesis topic</th>
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<tbody>
<tr>
<td><strong>When:</strong> Early October 2005</td>
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<tr>
<th>Summer 2007</th>
<th>Select thesis committee, prepare thesis proposal, present research proposal to committee. Members of the thesis committee must receive the proposal one week in advance of the defense.</th>
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<tbody>
<tr>
<td><strong>Deadline:</strong> End of Semester</td>
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